RESILIENT PEDESTAL HEAD FOR A RAISED ACCESS FLOOR SYSTEM

Field of the Invention

This invention is directed generally to raised access floors having a plurality of individual floor panels supported by pedestals and, more particularly, to a resilient pedestal head for supporting the floor panels.

Description Of Related Art

Raised access floors are widely used in commercial and industrial buildings where communication lines, air ducts, and other utilities are frequently altered or supplemented. These floors are a convenient way to hide utilities while offering easy access as needed. Raised access floors typically include a plurality of floor panels supported by a series of pedestals, which are typically arranged in a grid or matrix arrangement. The base of the pedestal attaches or rests on a subfloor. The floor panels are readily removable from the installed access floor and can be interchangeable with other floor panels. The pedestals can be adjustable to vary the finished floor height, and each pedestal usually includes a pedestal head. The floor panels are secured to or simply rest on the pedestal heads.

It is important that raised access floors be level and the individual panels aligned. Unlevel access floors and misaligned panels can result in difficulties in moving equipment over the raised floor due to differences in height between adjacent panels or gaps between panels. Additionally, deflection of a floor panel subject to a heavy load may cause the floor to be uneven, further complicating the movement of equipment over or storage of equipment on the floor. Furthermore, misaligned panels can result in inefficiencies in under-floor heating, ventilation, and air conditioning (HVAC) systems, and, of course, are not aesthetically pleasing in appearance.

By their very nature – being modular and individually removable – individual panels can become displaced out of the level plane of the floor, that is, panel edges can become misaligned creating gaps or variations across the floor. This can be a problem

both during installation and use. As discussed above, floor panels can be secured to pedestal heads or can simply rest on the pedestal heads. Panels that can be secured typically include a hole in each corner that penetrates the entire floor panel. One type of conventional pedestal head includes a square, flat plate that generally includes four holes to receive fastening elements, such as bolts, to secure the corners of four floor panels to the pedestal head. Installing such floor systems requires manually aligning the holes in floor panels with holes in the flat plate pedestal head. However, when securing the floor panel to the conventional flat-plate pedestal head, differences in dimensions due to typical manufacturing tolerances often cause the bolts to be disposed in an oblique position with respect to an axis perpendicular to the subfloor. Because these conventional flat-plate pedestal heads are rigid, the differences in dimensions produced by manufacturing tolerances often results in gaps and misalignment of the edges of adjacent floor panels, which can produce an uneven floor surface. In general, installers utilize tools, such as hammers to apply external forces to attempt to bend, i.e., plastically deform, the pedestal head and/or the fastening elements until adjacent floor panels are level and aligned. However, the rigidity of the pedestal heads themselves hinders attempts to align misaligned floor panels.

Another conventional pedestal head – the dual-level pedestal head – attempts to address the problem of imprecisions inherent in aligning floor panels that are secured to flat-plate pedestal heads. The conventional dual-level pedestal head generally includes an elevated bracket attached to the top surface of a square flat plate, thus dividing the square plate into four separate quadrants. This design permits an installer to slide or place the corners of the floor panels against the elevated bracket, which is an attempt to minimize the amount of manual alignment required by the installer. A further refinement to this conventional design includes raised elements on the lower, or flat-plate, portion of the dual-level pedestal head adapted to engage a corresponding recess or mating surface on the lower surface of the floor panels. Such refinements are often described as positive positioning or locking devices. While these types of features may help reduce the imprecisions inherent in manually aligning holes in the floor panels with holes in the pedestal head, such conventional pedestal heads still do not overcome all of

the problems of misaligned floor panels due to imprecisions in manufacturing the floor panels and the holes therein, and the like. Moreover, it is believed that the elevated brackets attached to the top surface of the flat plate in the dual-level pedestal head design increase the rigidity of an already rigid flat plate. Thus, it is believed that this additional rigidity further compounds misalignment caused by manufacturing imprecisions as well as frustrates attempts by installers to manually manipulate the floor panels into alignment by deforming the pedestal head and/or the fastening elements.

A related problem with conventional, rigid pedestal heads of both flat and dual-level designs is their propensity to plastically deform under certain loading conditions, which give rise to misalignment of the attached panels during use. Conventional pedestal heads generally support a small portion – typically the corners of the floor panels – of the lower surface of the floor panels. Loads that are applied to the corner of the floor panels act in direction substantially along the axial length of the pedestal, and are thus, resisted by the pedestal itself. However, loads that are applied away from the corners of the floor panels, e.g., near the middle of the floor panel, create large moments about the pedestal. These loads are resisted by the ability of the pedestal head to resist moments. It is believed that heavy loads applied away from the pedestal can cause the pedestal head to deform permanently. Thus, even conventional access floors that have been properly aligned when installed, may become misaligned following application of a heavy load to the floor panels. Because conventional pedestal heads are rigid and permanently deform under such loads, the pedestal heads and attached floor do not realign if the load is removed.

Floor panels that have carpeting or laminate applied to their outer surface lack a hole in each corner. Instead of being secured to the pedestal head, such floor panels merely rest on the pedestal head. These floor panels usually do not experience the misalignment during installation as do floor panels that are secured to the pedestal heads. During use, however, unsecured floor panels can be susceptible to misalignment, just as the secured floors described above. But as unsecured floor panels are less rigid than

secured floor panels, unsecured floor panels can become misaligned at loads lower than those required to deform and misalign secured floor panels.

The foregoing demonstrates that known raised access floors suffer from a number of disadvantages including pedestal heads that do not compensate for manufacturing tolerances of floor panels and/or permanently deform after a load is applied to the floor panel, such that there is a resulting mismatch of the edges and/or top surfaces of adjacent floor panels.

Summary Of The Invention

The invention solves the problems and avoids the disadvantages of the prior art by providing a pedestal head that is sufficiently resilient to allow for alignment of the floor panels during installation of the floor panels and to allow individual access floor panels to maintain their originally-aligned position after having been subjected to a heavy load during use. In particular, the invention accomplishes this by providing a resilient pedestal head for use in supporting floor panels of an elevated flooring system. The resilient pedestal head includes a base and an arm extending from and supported by the base for cantilevered movement relative thereto. The base has a first surface, disposed in a first plane, configured to support a first portion of a corner of a floor panel. The arm has a second surface configured to support a second portion of the corner of the floor panel. The second surface is disposed in a second plane generally parallel to the first plane in a first configuration of the pedestal head. The arm is deflectable by the weight of a panel mounted thereon to define a second configuration in which the second surface is nonparallel to the first plane. The base may also include additional arms for supporting additional floor panels. Each arm extends from and is supported by the base for cantilevered movement relative thereto. Each arm also has a surface disposed in the second plane for supporting another floor panel. In a preferred embodiment, four arms are provided, two on each side of the base, to support the corners of four panels. The arms on each side of the base may define, with the base, a generally u-shaped cross-section for supporting the panels mounted on the rear in a substantially level, aligned position regardless of the differences in dimensions caused by variations in

manufacturing tolerances. Each arm may have an L-shaped cross sectional shape defined as a downwardly extending projection and a flange, generally perpendicular thereto. The distance between adjacent projections of the arms on each side of the base may vary to bias the arms into a position capable of providing restoring moments tending to offset deflections of the panels mounted on the arms due to manufacturing tolerances.

According to another aspect of the invention, an elevated floor system is provided for supporting access floor panels, which includes first and second panels each having a corner and a pedestal having a head for supporting first and second panels. The pedestal includes a base having a first mounting surface supporting first portions of the corners of the first and second floor panels. The base also has first and second cantilevers extending therefrom. Each cantilever has a second mounting surface vertically spaced from the first surface and supporting a second portion of the corner of one of the first and second floor panels. The first and second mounting surfaces are disposed in substantially parallel planes prior to mounting the panels thereon. The first and second cantilevers are deflectable relative to the base under the weight of the first and second panels mounted thereon to define a second configuration in which the first and second surfaces are nonparallel. The second mounting surface of each cantilever may include a first hole and the first and second floor panels each may include a second hole. The first and second holes may be aligned to receive a fastener when one of the floor panels is mounted to one of the arms such that connection of the panels to the arms by fasteners force the arms to deflect into the second configuration due to dimensional variations between the panels and the head caused by manufacturing tolerances.

In yet another aspect of the invention, a method of installing an elevated floor system composed of floor panels supported on a subfloor by pedestals having a pedestal head for supporting upper and lower portions of each floor panel on first and second vertically spaced mounting surfaces of the pedestal head is provided. The method includes the steps of a) disposing the upper portion of a first panel on the first mounting surface of a pedestal head and the lower portion of the first panel on a portion of the second mounting surface of the pedestal head; b) connecting the first floor panel to the

second mounting surface of the pedestal head; c) disposing the upper portion of a second panel on the first mounting surface of the pedestal head and the lower portion of the second panel on another portion of the second surface of the pedestal head; and d) connecting the second floor panel to the second mounting surface of the pedestal head such that the panels create moments deforming the pedestal head to a position in which the first and second panels are non-parallel to each other. In addition the pedestal head may be plastically deformed to align the first and second panels in a level plane by applying a force in a region of the connected floor panels proximate the pedestal head, or applying a force to at least one of the first and second panels at a location spaced from the pedestal head. The connecting steps may include the steps of aligning a hole in the first floor panel with a first hole in the second surface of the pedestal head, and aligning a hole in the second floor panel with a second hole in the second surface of the pedestal head.

Additional features, advantages, and embodiments of the invention may be set forth or apparent from consideration of the following detailed description, drawings, and claims. It is to be understood that the foregoing summary of the invention and the following detailed description are exemplary and intended to provide further explanation without limiting the scope of the invention as claimed.

Brief Descriptions Of The Drawings

The accompanying drawings, which are incorporated herein and constitute part of this specification, illustrate preferred embodiments of the invention, and, together with the detailed description below, serve to explain the principles of the invention.

In the Drawings:

Figure 1 is a perspective view of a raised access floor structure with one panel removed to partially expose several resilient pedestal heads constructed according to the principles of the invention.

Figure 2 is a perspective view of a pedestal that may be used to support the resilient pedestal head of the invention.

Figure 3 is an enlarged perspective view of one of the resilient pedestal heads of the invention shown in Figure 1.

Figures 4A and 4B are plan and partial cross sectional views, respectively, of the pedestal head shown in Figure 3, with Figure 4B being taken along lines B-B of Figure 4A. Figure 5 is a plan view of a template for forming the pedestal head shown in Figure 3.

Figure 6 is a partial perspective view of a floor panel that may be used with the pedestal of the invention.

Figure 7 is a perspective view of a pedestal, pedestal head and partially-installed access floor constructed according to the invention.

Figures 8A – 8C are cross sectional views of the resilient pedestal head of the invention with attached floor panels showing three different positions the assembly may take based upon variations in dimensions produced during manufacture.

Figure 9 is a perspective view of second embodiment of a resilient pedestal head constructed according to the principles of the invention.

Figures 10A and 10B are plan and partial cross sectional views, respectively, of the pedestal head shown in Figure 9, with Figure 10B being taken along lines B-B of Figure 10A.

Figure 11 is a plan view of a template for forming the pedestal head shown in Figure 9.

Detailed Description Of The Preferred Embodiments

Reference will now be made in detail to preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. Figure 1 shows a perspective view of part of a raised access floor system 10 constructed in accordance with a preferred embodiment of the invention. As shown in Figure 1, the raised access

floor system 10 is installed on a subfloor 20 and generally includes floor supports such as pedestals 30 having resilient pedestal heads 40 used to support floor panels 50.

Typically the pedestals 30 are arranged in a grid-like pattern with pedestals 30 spaced substantially equidistant from one another. The height of pedestals 30 may be adjustable as is known in the art. The pedestals 30 support the corners of the floor panels 50, thus forming the raised floor system 10. Each one of the pedestals 30 that is located in middle portions of the raised floor system 10 supports corners of four of the floor panels 50. Each one of the pedestals 30 that is located along edge portions of the raised floor system 10 supports corners of two of the floor panels 50, while each one of the pedestals 30 located at an end portion of the raised floor system 10 supports a corner of one of the floor panels 50. The panels 50 may rest on or be attached to pedestal heads 40, and each one of the floor panels 50 is individually removable to provide access to the subfloor 20 located beneath the raised flooring.

Pedestal 30 is preferably an adjustable pedestal of the type, for example, shown in Figure 2. However, any conventional type of pedestal may be used in accordance with the principles of the invention. The pedestal 30 in Figure 2 generally includes a base 32, a post 34, a rod 36, and an adjusting device 38. The base 32 is shown as being generally square-shaped but can be a variety of other geometric shapes, including circular or rectangular, and the corners of the base 32 may be rounded as shown in Figure 2. The base 32 may be a substantially flat plate. Alternatively, the base 32 can include raised or web-like portions, which are believed to impart greater structural strength and rigidity than a substantially flat plate. The base 32 can rest on or be secured to the subfloor 20, as is known in the art. If the base 32 is to be secured to the subfloor 20, a plurality of anchor holes 33 may be disposed in the base 32. The anchor holes 33 may be adapted to accept conventional anchor devices, including concrete expansion anchors. Alternatively, the base 32 may be secured to the subfloor 20 by an adhesive or any other method or means known in the art.

The post 34 is coupled rigidly to the base 32 and extends substantially perpendicularly therefrom. The post 34 has a lower end 34a attached to the base 32 and

an upper end 34b adapted to receive the rod 36. The cross-section of the post 34 can be a variety of geometric shapes, including circular, rectangular, or square, but as shown in the figures, the cross-section of the post is square. The corners of post 34 may be square, beveled or rounded. The post 34 and the base 32 may be formed separately or as a unitary whole. If the post 34 and the base 32 are formed separately, the lower end 34a of the post 34 may be fixedly connected to the base 32 by at least one weld 35. Alternatively, the lower end 34a of the post 34 may be connected to the base 32 by providing the base 32 with a raised threaded portion (not shown) and the lower end 34a of the post 34 with a complementary surface (not shown) adapted to engage the threaded portion of the base 32. Again, any other means known in the art for making or connecting the base and post together to form the pedestal may be employed.

If an adjustable height pedestal is employed, the rod 36 may be coupled to the upper end 34b of the post 34 in any number of ways known in the art to provide a lockable, variable height between subfloor 20 and floor panels 50. For example, in the illustrated embodiment, the rod 36 is slidably received within the upper end 34b of the post 34. The outer surface of the rod 36 may be threaded along the entire axial length or a sufficient portion of the axial length of the rod 36 to engage the inner surface of an adjusting device 38, such as nut 38 described below, which sits on top of post 34 and receives the lower end of the rod 36. By virtue of the engagement between the rod 36 and nut 38, rod 36 telescopes within the post. Thus, the height of the pedestal 30 can be adjusted by rotating nut 38, which varies the position of the rod 36 with respect to the post 34. Once a desired height of the pedestal 30 is obtained, the position of the rod 36 with respect to the post 34 is fixedly secured in a predetermined position by a locking projection that extends from the threaded surface on the end of the rod 36 and prevents rod 36 from rotating within post 34.

As shown in Figure 2, nut 38 may include one or more axial projections 38a. The axial projections 38a extend from the top and bottom opposing faces of nut 38 (only the top face is shown in Fig. 2). Two axial projections 38a are provided to allow either end of the adjusting device 38 to be threaded onto the rod 36, but only one is required to

prevent rotation of nut 38. Nut 38 may be threaded onto bottom end of rod 36 if the top end is already connected to the pedestal head 40 (as shown in Figure 3) into a desired position along the length of the threads. If rod 36 and pedestal head 40 are not yet connected, nut 38 may be threaded onto top end of rod 36. When the nut 38 is seated on the top surface of the upper end 34b of the post 34, the bottom projection 38a of nut 38 prevents rotation of the nut relative to post 34. Furthermore, the weight of the installed floor panels 50 upon the pedestal head supported by the post 36 (Figure 3) provides additional compressive loads that act to fully seat the nut on the post 34, thus preventing rotation of nut 38 in use.

Any other adjustable or non-adjustable pedestal known in the art may be used with the resilient pedestal head of the invention. For example, the adjusting device 38 can be a seating-lock type, a spring stop-nut type, a prevailing torque type, a wedge type, or a quick-release type. In addition, the inner surface of post 34 may be threaded to engage directly the threads on rod 36 and a conventional set screw threadably received in a side of post 34 may be used to lock the in position with respect to post 34.

Referring to Figures 3, 4A, and 4B, a resilient pedestal head 40 made in accordance with the principles of the invention is shown. As shown in Figure 3, the pedestal head 40 is fixedly connected to the rod 36 of the pedestal 30 by any means known in the art, such as welding or by providing the pedestal head 40 with a complementary surface (not shown) adapted to engage the threaded surface of the rod 36. Thus, as described above, the position or height of the pedestal head 40 relative to the subfloor 20 changes when the height of rod 36 is adjusted within post 34 by nut 38. Pedestal head 40 generally includes a top plate 42 having four L-shaped arms formed by downwardly depending projections 46 and flanges 44 outwardly extending therefrom in a cantilevered fashion for supporting floor panels 50. As the top plate 42 also is adapted to support one or more floor panels 50 in a manner discussed herein, the top (uppermost) surface of the top plate 42 will typically be substantially flat as illustrated. Thus, the top surface of the top plate 42 lies in a plane substantially horizontal and substantially transverse to vertical axis A shown in Figure 4B. Extending outwardly from the center

of the top plate 42 are four extensions 42a, each of which preferably have substantially the same length and such that the top surface of plate 42 has a generally cross-shape. The extensions 42a form corner regions 42b on the top surface to receive a corner of a panel 50. Only two of the four extensions 42a include the projections 46 and panel supporting flanges 44. The other two of the extensions 42a include downwardly depending skirts 42c to strengthen top plate 42. The top plate 42 may include a number of holes 42d formed in extensions 42a for manipulating and aligning the pedestal head 40 during manufacture, e.g. during the stamping and forming process described below. The projections 46 depend downwardly from two opposed extensions 42a such that the flanges 44 of each L-shaped arm are spaced from and substantially parallel to the surface of the top plate 42. Flanges 44 may have substantially the same length and are adapted to support a corner portion of the floor panels 50, as described in more detail herein. As shown, the lengths of the flanges 44 may be similar to the lengths of the extensions 42a. Each of the flanges 44 may include at least one alignment hole 45, which may be threaded and include an upstanding projection 45a. The alignment hole 45 is adapted to receive a fastening element 60, which is shown in Figure 6. When the alignment hole 45 fully receives the fastening element 60, the floor panel 50 is attached to the pedestal head 40. As shown best in Figure 4B, the projection 45a protrudes above the top surface of the flanges 44 and is received in a complementary countersunk hole (not shown) in the lower surface 56 of floor panels 50 to facilitate alignment and connection of the floor panels 50 to the pedestal head 40. The outer walls of the projection 45a may be angled with respect to a centerline C of the alignment hole 45 as shown in Figure 4B to form a complementary engaging surface with the countersunk hole (not shown). Alternatively the outer walls of the engaging projection 45a could be parallel to the centerline C of the alignment hole 45.

Referring to Figure 4A, distances C_1, C_2, C_3, and C_4 each represent the distance between the centerline of an alignment hole 45 and the center of one of the extensions 42a of the plate 42. Preferably, the distances C_1, C_2, C_3, and C_4 are substantially the same. As shown, C_{34} represents the total distance between the centerlines of the

alignment hole 45 in the flanges 44 extending from projection 46 on the same extension 42a.

The L-shaped arms 46, 44 of each extension 42a may be symmetrically disposed in pairs about the axis A as shown in the side view of Figure 4B. Extension 42a and L-shaped arms 46, 44 on each side of plate 42 have an inverted, generally U-shape cross-section as shown best in Figs. 3 and 4B. The distance D_1 represents the distance between the inner walls of a pair of projections 46 at the bottom of the top plate 42, while the distance D_2 represents the distance between the inner walls of the pair of projections 46 at the junction between the projections and flanges 44. Because the L-shaped arms 46, 44 are designed to deform under panel loading as described below, and in certain conditions may deform inwardly towards each other, the distance D_2 may be greater than the distance D_1. In the preferred embodiments of the invention, D_2 is greater than D_1 by approximately five one hundredths of an inch, but this dimension will obviously vary depending upon the particular floor and application being designed. Each L-shaped arm 46,44 is supported solely by a portion of a respective extension 42a, thus forming a cantilever, which is deformable by loads typically encountered during installation of the raised access floor system 10, described in more detail in Figures 8A-8C.

The top plate 42, extensions 42a, projections 46, and flanges 44 of pedestal head 40 can be formed integrally by any number of conventional forming techniques, such as stamping, casting, or the like. As shown in Figure 5, the pedestal head 40 may be stamped from a single piece of material. Figure 5 illustrates a template for stamping the plate 42 of the invention. The dashed lines on the template illustrated in Figure 5 indicate where the stamped template is to be shaped to form the pedestal head 40 of the invention. Alternatively, the pedestal head may be constructed from any number of separately formed pieces that are subsequently attached together. The material of the pedestal head 40 can include a variety of metals or composites as long as they have sufficient strength, durability, and resiliency to support access floor panels according to the principles of the invention. Currently, the preferred material for the pedestal head 40 is half-hard, high density hot-dipped galvanized steel coil having a yield strength of at

least 50,000 pounds per square inch. Preferably, the thickness of the plate is less than one-eighth of an inch, but may, of course vary depending upon the particular application. Pedestal head 40 can be used with conventional panels of the type, for example, described herein as floor panels 50. Any type of panel known in the art may be used in accordance with the invention. Referring to Figure 6, a section of a corner of one of the floor panels 50 is shown. Each of floor panels 50 has an upper surface 52, an intermediate portion 54, and a lower surface 56. The upper surface 52 and the lower surface 56 are shown as substantially square in shape, but obviously can be formed in a variety of geometric shapes. Also, the floor panels 50 can be cut or formed to adapt the floor system 10 to a particular configuration. The upper surface 52 typically is substantially parallel to the lower surface 56. The surface area of the upper surface 52 is shown as being greater than the surface area of the lower surface 56, thus forming a lip or an overhang 52a, which may be extended on the order of less than an inch from the side of intermediate portion 54. The intermediate portion 54 extends between and connects the upper surface 52 and the lower surface 56. The intermediate portion 54 may be hollow, may include a stiffening structure, or may be filled with various materials, including wood, metal, composites, or concrete or other materials to achieve different strength or aesthetic characteristics as known in the art. Thus, depending upon the application, different types of floor panels may be used. Although not shown, a floor panel lacking panel holes because laminate or carpeting will be applied to the upper surface of the floor panel may also be used.

The floor panels 50 may be affixed to pedestal head 40 by fastening elements 60 such as bolts, screws, or pins, or may simply rest on the pedestal head 40. In either case, the floor panels 50 are removable for access to an area below the floor panels 50. In the preferred embodiments, several panel holes 58 are formed in the floor panels 50. Each of the panel holes 58 is disposed in a corner region of the floor panels 50. The panel holes 58 traverse the entire floor panel 50, i.e., they extend through the upper surface 52, the intermediate portion 54, and the lower surface 56. The panel 50 is generally aligned on the pedestal head 40 when disposed in a corner region 42b between two extensions 42a. To more precisely align the hole 58 in the panel 50 with the alignment hole 45 in

pedestal head 40, the lower surface 56 of at least one corner of panel 50 has countersunk hole (not shown) adapted to receive the engaging projection 45a of the alignment hole 45.

The installation and use of the raised access floor system 10 of the invention will now be described. Referring to Figures 7 and 8A, after the pedestals 30 are placed upon the subfloor 20, the desired number of floor panels 50 are placed upon the pedestal heads 40 such that the upper surface 52 of the floor panels 50 rests on the top plate 42 and the extensions 42a of the pedestal head 40, and the lower surface 56 of the floor panel 50 rests on the flanges 44. As described above, as a corner of floor panel 50 is manipulated onto the pedestal head 40, receipt of the projection 45a of the alignment hole 45 into a complementary engaging surface of the lower surface 56 of the floor panel 50 aligns the hole 45 in the pedestal head 40 and the panel hole 58. To secure a floor panel 50 to a pedestal head 40, fastening elements 60 are inserted into panel holes 58 and alignment holes 45 and tightened to connect the panel 50 to pedestal head 40. The method of securing floor panels 50 to pedestal head 40 is the same regardless of the number of floor panels 40 to be secured. For example, as shown in Figure 8A, a first panel 50 is placed on a corner 42b of pedestal head 40 such that projection 45a on pedestal head 40 is received within the countersunk hole (not shown) in panel 50. Then, fastening element 60 passes through panel hole 58 and is torqued down into alignment hole 45 to secure panel 50 to pedestal head 40. The same is done with other panels 50. The steps described herein can be performed in any order.

Referring to Figures 8A – 8C, certain aspects of the installation of floor panels 50 onto pedestal head 40 now will be described to illustrate one of the benefits of the resilient pedestal head of the invention. Figures 8A – 8C illustrate two floor panels 50 secured to one of the pedestal heads 40 by two fastening elements 60 in three different configurations by virtue of dimensional variances caused by, e.g., manufacturing tolerances. Figure 8A shows the level configuration that occurs when the panel holes 58 are perfectly aligned, while Figures 8B and 8C show angled configurations that can occur when the panel holes are not aligned but within tolerance. Referring to Figure 8A,

the distance between the centerlines of the panel holes 58 in two adjacent floor panels 50 is represented by C_p, and the distance between centerlines of corresponding alignment holes 45 is represented by C_{34} (see discussion of Figure 4A above). In Figure 8A, the distance C_p is substantially equal to the distance C_{34} and the top surfaces of the panels 50 are aligned and in the same level plane. When distance C_p is greater than the distance C_{34}, by even very small amounts, significant benefits can be achieved to overcome misalignment of floor panels 50 during installation caused by dimensional variations. For example, it has been found that when distance C_p is slightly greater than C_{34}, for example by a difference on the order of 0.010 inches, sufficient pre-bias is produced in the L-shaped arm 46,44 of the pedestal head 40 to exert forces F_1 and F_2 and restoring moments M_1 and M_2 that tend to press the edges of adjacent floor panels 50 together after fastening elements 60 are attached to the pedestal head 40. In a preferred embodiment of the invention, C_p may be 2.000 inches and the distance C_{34} may be 1.990 inches. Under these conditions, as the panel holes 58 are aligned with holes 45 in Figure 8A are perfectly aligned, when panels 50 are screwed in, the two floor panels 50 will be aligned with little or no manipulation required by the installer. Although prebiasing the head by designing C_p to be greater than C_{34} is preferred and is a feature shown in Figures 8A and 8B, the invention may be practiced with C_p being equal to C_{34}.

Figures 8B and 8C illustrate the alignment feature produced by the resilient head of the invention when C_p is greater than C_{34} by more than 0.010 inches or C_p is less than C_{34}. In Figure 8B, the distance C_p between the panel holes 58 of adjacent panels 50 is greater than the distance C_{34} by more than 0.010 inches. It is believed that such a discrepancy between the distance C_p and the distance C_{34} can result, for example, from tolerances in manufacturing the floor panels 50. As the fastening elements 60 are torqued down, the increased distance of C_p causes the fastening element 60 to enter aligning hole 45 at an angle transverse to axis A. Because the cantilevered construction imparts flexibility in L-shaped arm 46,44, the pedestal head 40 deforms such that distance D_2 becomes gradually less than distance D_1 as fastening element continues to be tightened. This deflection of the pedestal head 40 causes the interface between adjacent panels 50 to bow in an upward direction relative to the subfloor 20 as shown in Figure

8B. The amount of deflection illustrated in Figure 8B is exaggerated for illustration purposes and typically may be on the order of hundredths of an inch. After the fastening elements 60 have been secured fully to the pedestal head 40, a load can be applied by the installer to the bowed floor panels 50 in a region near the pedestal head 40 to permanently deform the pedestal head 40 to the level configuration illustrated in Figure 8A. Preferably, the load is applied substantially along the axis A in a direction toward the subfloor 20. Thus, in this manner, the floor panels 50 can then be aligned in a level, substantially horizontal position.

Figure 8C illustrates the condition when the distance C_P is less than the distance C_{34}. As the fastening elements 60 are torqued down, the decreased distance of C_p causes the fastening element to enter aligning hole 45 at an angle transverse to axis A. Because the cantilevered construction imparts resiliency in L-shaped arm 46,44, the pedestal head 40 deforms such that distance D_2 becomes greater than distance D_1 as fastening element 60 continues to be tightened. This deflection of the pedestal head 40 causes the interface between adjacent floor panels 50 to bow in a downward direction relative to the subfloor 20. Again, the amount of deflection illustrated in Figure 8C has been exaggerated for illustration purposes, but may be on the order of hundredths of an inch in practice. After the fastening elements 60 have been secured to the pedestal head 40, a load can be applied to the bowed floor panels 50 by the installer to permanently deform the pedestal head 40 to the level configuration illustrated in Figure 8A. Preferably, the load is applied in a direction toward the subfloor 20 on an end of the panel 50 away from the pedestal head 40. Thus, in this manner, the floor panels 50 can then be aligned in a level, substantially horizontal position. Once the raised access floor system 10 has been completely installed and leveled, the system 10 is rigid by virtue of the strength of the individual pedestal heads 40 and by the overall constraint of the interconnected system 10. The system 10 of interconnected floor panels 50 and pedestal heads 40 provide greater rigidity than is to be found in an individual pedestal head 40 alone.

In accordance with the present invention, the floor panels 50 do not have to be secured to the pedestal heads 40. For example, as described above, where carpet or

laminate is applied to the upper surface 52 of the floor panels 50, the panel holes 58 are covered, and thus, unable to accommodate the fastening elements 60. The panels 50 simply rest upon the pedestal head 40. As there are no fastening elements producing moments to deform the pedestal head 40, the adjacent panels are aligned without the need for manipulation. Of course, there may be some minor misalignment resulting from the weight of floor panels 50 alone. However, such misalignment should be difficult to detect and can easily be corrected by minor physical manipulation by the installer. Figure 8A also represents the installed configuration where the floor panels 50 simply rest on the pedestal heads 40. Figure 8B also is an exaggerated representation of the unsecured configuration when a heavy load is applied to the floor panels 50 away from the pedestal head. Again, the amount of actual deflection may be on the order of hundredths of an inch. After the load is removed from the pedestal heads 40, the cantilevered construction of L-shaped arm 46,44 provides sufficient resiliency to pedestal head 40 that pedestal head 40 returns to the level configuration illustrated in Figure 8A. Because in this configuration the panels are not secured to the head by fastening elements, the entire system 10 is less rigid than the system 10 in which the panels are secured. Thus, even though this unsecured configuration may deflect at lower loads, the resiliency of the individual panel head 40 is sufficient to return to the level configuration illustrated in Figure 8A when the localized load is removed.

Applicants have performed tests to demonstrate the resiliency and strength of the invention. Applicants attached a single Maxcess Technologies, Inc. RWC 400 floor panel to a pedestal head of the invention constructed according to the embodiment shown in Figure 3. The RWC 400 floor panel is a commercially available panel marketed by the assignee of the invention that is a resistance-welded, concrete-filled steel panel designed for heavy-duty applications. In performing the test, point loads were applied to the attached floor panel six inches in from both sides of the corner mounted on the pedestal head. Strain gauges were placed near the point of application of the load on the panel and at the corner bolt hole on the pedestal head to measure the deflection of both the panel and the pedestal head. At a load of 800 pounds, the pedestal head deflected 0.020 inches and with no measurable permanent deflection. Thus, the head was

elastically deformed under this loading. At this load, the panel deflected 0.040 inches. At a load of 1,350 pounds, the pedestal head deflected 0.035 inches and with a permanent deformation of 0.004 inches. At this load, the panel deflected 0.080 inches. The ultimate load of the pedestal head before failure was determined to be greater than 3,000 lbs. with a corresponding permanent deformation of 0.10 inches.

Figures 9, 10A, 10B, and 11 illustrate another embodiment of a pedestal head of the invention. Like numbers will be used to describe like elements. As shown in Figure 9, the pedestal head 140 is fixedly connected to the rod 136 by any means known in the art, such as welding or by providing the pedestal head 140 with a complementary surface (not shown) adapted to engage the threaded surface of the rod 136. As described above, the position or height of the pedestal head 140 relative to the subfloor 20 changes when the height of rod 136 is adjusted within post 134 by nut 38. Pedestal head 140 generally includes a top plate 142 having four L-shaped arms formed by downwardly depending projections 146 and flanges 144 outwardly extending therefrom in a cantilevered fashion for supporting floor panels 50. As the top plate 142 is adapted to support one or more floor panels 50 in a manner discussed herein, the top (uppermost) surface of the top plate 142 will typically be substantially flat as illustrated. Thus, the top surface of the top plate 142 lies in a plane substantially horizontal and substantially transverse to vertical axis A shown in Figure 10B. Extending outwardly from the center of the top plate 142 are four extensions 142a, each of which preferably have substantially the same length. The top surface of extensions 142a form four corners 142b on the top surface each of which receives a corner of a panel 50. Top plate 142 includes skirt 142c to strengthen top plate 142. Unlike the embodiment shown in Figure 3, the L-shaped arms 146,144 in this embodiment depend from each extension 142a, such that each extension has a strengthening skirt on one side and an arm 146,144 on the other. The top plate 142 may include a number of holes 142d formed in extensions 142a for manipulating and aligning the pedestal head 40 during manufacture of the pedestal head 140, during the stamping and forming process described below. The projections 146 depend downwardly from one side of each extension 142a such that the flanges 144 are spaced from and substantially parallel to the surface of the top plate 142. Flanges 144 each have substantially the same

length and are adapted to support a corner portion of the floor panels 50, as described in more detail herein. As shown, the lengths of the flanges 144 may be similar to the lengths of the extensions 142a. Each of the flanges 144 may include at least one alignment hole 145, which may be threaded and include an upstanding projection 145a, and functions in the same manner as discussed above in connection with the first embodiment of pedestal head 40 to facilitate alignment and connection of the panels 50 to head 140.

Referring to Figure 10A, distances C_1, C_2, C_3, and C_4 each represent the distance between the centerline of an alignment hole 145 and the center of one of the extensions 142a of the plate 142. Preferably, the distances C_1, C_2, C_3, and C_4 are substantially the same. As shown, C_{34} represents the total distance between the centerlines of the alignment hole 145 in the flanges 44 on one side of the plate.

The projections 146 of each extension 142a may be parallel to the vertical axis A as shown in Figure 10B. The top plate 142, extensions 142a, projections 146, and flanges 144 of pedestal head 140 can be formed integrally by any number of conventional forming techniques, such as stamping, casting, or the like. As shown in Figure 11, the pedestal head 140 preferably is stamped from a single piece of material. Figure 11 illustrates a template for stamping the plate 142 of the invention. The dashed lines on the template illustrated in Figure 11 indicate where the stamped template is to be shaped to form the pedestal head 140 of the invention. Like the first embodiment, the pedestal head may also be constructed from any number of separately formed pieces that are subsequently attached together, and the material of the pedestal head 40 can include a variety of metals or composites as long as they have sufficient strength, durability, and resiliency to support access floor panels according to the principles of the invention. The installation and use of the embodiment of the invention illustrated by Figures 9, 10A, 10B, and 11 are substantially the same as that described above and in Figures 8A – 8C, and thus, will not be repeated here.

Although the foregoing description is directed to the preferred embodiments of the invention, it is noted that other variations and modifications will be apparent to those

skilled in the art, and may be made without departing from the spirit or scope of the invention.